

UltraRadiac™  
Personal Radiation Monitor

---

User's Manual

9236123G

Body: 9236048G

Copyright 2006, Canberra Industries, Inc. All rights reserved.

The material in this document, including all information, pictures, graphics and text, is the property of Canberra Industries, Inc. and is protected by U.S. copyright laws and international copyright conventions.

Canberra expressly grants the purchaser of this product the right to copy any material in this document for the purchaser's own use, including as part of a submission to regulatory or legal authorities pursuant to the purchaser's legitimate business needs.

No material in this document may be copied by any third party, or used for any commercial purpose, or for any use other than that granted to the purchaser, without the written permission of Canberra Industries, Inc.

Canberra Industries, 800 Research Parkway, Meriden, CT 06450  
Tel: 203-238-2351 FAX: 203-235-1347 <http://www.canberra.com>

The information in this document describes the product as accurately as possible, but is subject to change without notice.

Printed in the United States of America.

UltraRadiac is a trademark of Canberra Industries, Inc.

## Table of Contents

---

<b>1. Introduction . . . . .</b>	<b>1</b>
<b>2. Basic Functions . . . . .</b>	<b>4</b>
Powering the Unit . . . . .	4
Turning Off an Alarm . . . . .	4
Checking Your Stay Time . . . . .	6
Checking the Accumulated Dose . . . . .	6
Clearing the Accumulated Dose . . . . .	7
Reading the Alarm Thresholds . . . . .	7
Changing the Alarm Indicators . . . . .	8
Using the Backlight . . . . .	8
<b>3. Controls and Indicators . . . . .</b>	<b>9</b>
The Function Keys . . . . .	10
The Battery Life Indicators . . . . .	11
Attaching the Belt Clip . . . . .	12
The Carrying Case . . . . .	12
<b>4. Operational Verification Tests . . . . .</b>	<b>14</b>
Turning the Unit On . . . . .	14
Turning the Unit Off . . . . .	16
Instrument Test . . . . .	17
Display Test Sequence . . . . .	17
Ending the Display Test . . . . .	20
Backlight Test . . . . .	20

Sleep Mode Test . . . . .	21
Completing the Tests . . . . .	22
GM Tube Failure Indication . . . . .	22
Operation at Low Temperatures . . . . .	23
Error Displays . . . . .	23

## **5. Setting Up the Unit . . . . . 24**

The Rate Mode . . . . .	25
The Rate Alarms . . . . .	25
High Threshold . . . . .	25
Low Threshold . . . . .	26
Reading the Rate Alarm Thresholds . . . . .	26
Changing the Rate Alarm Indicators . . . . .	27
Changing the Rate Alarm Thresholds . . . . .	27
The Dose Mode . . . . .	30
The Dose Alarms . . . . .	31
High Threshold . . . . .	31
Low Threshold . . . . .	32
Reading the Dose Alarm Thresholds . . . . .	32
Changing the Dose Alarm Indicators . . . . .	33
Changing the Dose Alarm Thresholds . . . . .	33
The Source Finder Mode . . . . .	35
Enabling the Source Finder Mode . . . . .	36
Exiting the Source Finder Mode . . . . .	36
The Sleep Mode . . . . .	36
Enabling the Sleep Mode . . . . .	36
When the Unit Wakes Up . . . . .	37

Exiting the Sleep Mode . . . . .	38
The Data Logging Mode . . . . .	38
Capturing Data Pairs . . . . .	38
Viewing the Data Log . . . . .	39
Clearing the Data Log . . . . .	40
<b>6. Maintenance Procedures . . . . .</b>	<b>41</b>
Cleaning the Unit . . . . .	41
The Batteries . . . . .	41
Installing or Replacing the Batteries . . . . .	42
The Battery Compartment . . . . .	44
Latching the Compartment Door . . . . .	46
<b>A. Specifications . . . . .</b>	<b>47</b>
Features . . . . .	47
Detector . . . . .	48
Display . . . . .	48
Alarms . . . . .	49
Power . . . . .	49
Environmental . . . . .	50
Physical . . . . .	50
Qualification Testing . . . . .	51
Ordering Information . . . . .	51

<b>B. Default Alarm Settings . . . . .</b>	<b>52</b>
<b>C. Display Units . . . . .</b>	<b>54</b>
<b>D. Glossary . . . . .</b>	<b>55</b>
<b>E. Disposing of This Equipment . . . . .</b>	<b>57</b>

## 1. Introduction

---

### READ THIS



If you don't read anything else in this manual, read Chapter 2, Basic Functions, and Chapter 3, Controls and Indicators. These cover the basics of using the UltraRadiac™ Personal Radiation Monitor.

**Note:** Operational procedures are the responsibility of the UltraRadiac's users. Instructions provided in this manual are "how to's", not procedural recommendations.

Your UltraRadiac can measure and display both the instantaneous radiation dose rate (Rate), the amount of radiation being measured at this moment, and the total accumulated radiation dose received (Dose) since the dose memory was last cleared.

### **The Alarms**

The UltraRadiac's presettable alarms for both instantaneous Rate and cumulative Dose can alert you to hazardous conditions. When an enabled alarm's threshold is exceeded, a visual indicator will begin flashing and, optionally, an LED will blink and/or an audible alarm will sound. Some units also include a vibrator alarm.

### **The Radiation Units**

Depending on the model, your UltraRadiac is factory-set to display the Rate and the Dose in one of these units of radiation measurement:

- R (roentgen) – a measure of radiation exposure.
- Sv (sievert) – a measure of absorbed dose equivalent.

Most illustrations in this manual show the radiation units as  $\mu\text{R}$  (microroentgens, one millionth of a roentgen). The units are defined on pages 54–55.

### **Equipment Check**

If your organization's procedures require periodic equipment checks, refer to Chapter 4, Operational Verification Tests.



### **Setting Up the Unit**

The UltraRadiac has five modes: Rate, Dose, Source Finder, Sleep, and Data Logging. Chapter 5, Setting Up the Unit, describes them and tells you how to set and enable the Rate alarms and the Dose alarms.

### **Maintenance Procedures**

Chapter 6, Maintenance Procedures, lists the UltraRadiac's preventive maintenance checks and describes how to install or replace the batteries.

## 2. Basic Functions

---

The first time you take your UltraRadiac™ out of its shipping carton, you'll have to install its batteries. See "The Batteries" on page 41 for instructions.

### Powering the Unit

- ▶ To turn the unit on, press ON/OFF until *000* is displayed.
- ▶ Release ON/OFF.
- ▶ In a few seconds, the instantaneous rate will be displayed, with the word RATE at the top left of the screen.
- ▶ If a *b* or a blinking BAT indicator appears in the display or if the display is blank, refer to "The Battery Life Indicators" (page 11).
- ▶ To turn the unit off, press ON/OFF until *- - -* is displayed.

### Turning Off an Alarm

The UltraRadiac has two alarms, Low Level and High Level for each of two modes, Rate and Dose.

If any alarm sounds, the next four sections tell you how you turn it off.

- **Clearing the Low Rate Alarm**

- ▶ Press the CLR/TEST key to turn off the vibrator and the audio alert.
- ▶ The visual alerts will continue until the rate falls below the Low Rate Alarm threshold.

- **Clearing the High Rate Alarm**

- ▶ Press the CLR/TEST key to turn off the vibrator.
- ▶ The audio (if enabled) and visual alerts will continue until the Rate falls below the High Rate Alarm threshold.
- ▶ At that time, press the CLR/TEST key to turn off the alerts.

- **Clearing the Low Dose Alarm**

- ▶ Press the CLR/TEST key to turn off the vibrator and the audio alert.
- ▶ The visual alerts will continue until the Dose falls below the Low Dose Alarm threshold.
- ▶ To turn off the visual alerts, you'll have to clear the dose memory. See "Clearing the Accumulated Dose" on page 7.

- **Clearing the High Dose Alarm**

- ▶ Press the CLR/TEST key to turn off the vibrator.
- ▶ The audio (if enabled) and visual alerts will continue until the Dose falls below the High Dose Alarm threshold.
- ▶ To turn off the alerts, you'll have to clear the dose memory. See "Clearing the Accumulated Dose" on page 7.

### **Checking Your Stay Time**

- ▶ Press ALARM to see the number of minutes you can safely stay in the area at the current Dose Rate. Specific information on Stay Time is given on page 55.

**WARNING** If the Dose Rate goes up, your remaining Stay Time will go down.



You should check your Stay Time frequently when you are in the presence of radiation.

### **Checking the Accumulated Dose**

- ▶ Press DOSE to see the accumulated dose (the word DOSE is at the top right of the screen).

- ▶ To return to the Rate Mode, press the RATE key.

### **Clearing the Accumulated Dose**

- ▶ Press and hold DOSE + CLR/TEST.
- ▶ The display will flash for a few seconds, then clear the accumulated dose.
- ▶ To return to the Rate Mode, press the RATE key.

### **Reading the Alarm Thresholds**

- ▶ Press ALARM + RATE or ALARM + DOSE.
- ▶ You'll see an H, for High Level Alarm, displayed.
- ▶ To read the Low Level Alarm setting, press the RATE (DOSE) key again; the display will show an L.
- ▶ Press the CLR/TEST key; the flashing display will show the selected (H or L) alarm threshold setting.
- ▶ If the Vibrator Alarm has been activated, the display will alternate between the threshold value and a vertically scrolling horizontal bar (— —).

## Changing the Alarm Indicators

- ▶ Press the ALARM + RATE keys or the ALARM + DOSE keys.
- ▶ You'll see an H, for High Level Alarm, displayed.
- ▶ To change the Low Level indicators, press the RATE (DOSE) key again; the display will show an L.
- ▶ Press the CLR/TEST key to access the selected (H or L) indicators.
- ▶ Repeatedly press the ALARM key until you see the desired combination of indicators, AUDio, VISual, vibrator, or no indicators.

## Using the Backlight

In dim light, you can enable the unit's backlight to read the display.

- Press the LIGHT key.
- The display's backlight will turn on.
- To conserve battery power, the backlight will automatically turn off in about five seconds.

### 3. Controls and Indicators

This is a brief overview of the UltraRadiac's™ controls and indicators and its protective case. Each of the controls and indicators is covered in detail in the remaining sections of the manual.

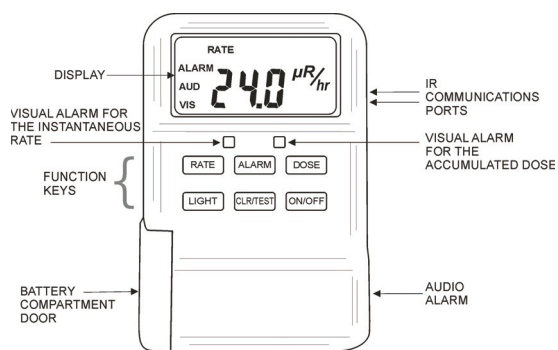


Figure 1 The UltraRadiac Front Panel

## The Function Keys

The primary function of each of the function keys is briefly described below. The programming functions of these keys are covered in Chapter 5, “Setting Up the Unit” (page 24).

<b>ON/OFF</b>	Press and hold to turn the unit on or off.
<b>RATE</b>	Press to change to the Rate Mode.
<b>DOSE</b>	Press to change to the Dose Mode.
<b>ALARM</b>	Press to see the Stay Time, the number of minutes you can safely stay in the area at the current Dose Rate. Specific information on Stay Time is given on page 55.

**WARNING** If the Dose Rate goes up, your remaining Stay Time will go down.



You should check your Stay Time frequently when you are in the presence of radiation.



**LIGHT**

In the dark, press to illuminate the display for about five seconds. Note that the backlight may not be visible in daylight or normal room lighting.

**CLR/TEST**

In the Rate Mode, press and hold to enable the Display Test Sequence (page 17).

### The Battery Life Indicators

The UltraRadiac has two battery life indicators. See “The Batteries” on page 41 for instructions on changing the batteries.

- If a blinking **b** is displayed, the unit has stopped functioning. Replace the batteries before the unit’s next use.
- If a blinking BAT is seen in the top-left corner of the display, the unit’s batteries have 10 hours or less of useful life. Replace the batteries as soon as possible.
- If the display is blank, the batteries are dead. Replace the batteries before the unit’s next use.

### **Remaining Battery Life**

In the Rate Mode with the BAT indicator blinking, press the CLR/TEST key. A three-digit number indicating the approximate remaining battery life, in minutes, will be displayed.

### **Attaching the Belt Clip**

To attach the supplied belt clip, screw the clip's two captive retaining screws into the threaded inserts at the top of the unit's rear panel.

**Note:** To prevent crossthreading damage, insert each screw loosely, then tighten them alternately a few turns at a time. Do not overtighten.

### **The Carrying Case**

If the belt clip is installed, remove it from the back of the UltraRadiac by unscrewing its two captive retaining screws and lifting the clip off the unit.

Now put the UltraRadiac into the carrying case with the display toward the bottom (closed) end of the case. To close the case, refer to Figure 2 and...

- ① Fold the top flap down over the front of the case.
- ② Pull the narrow strap across the top flap.
- ③ Secure the narrow strap to both the top flap and the side of the case.
- ④ Thread your belt through the slots in the belt loop.

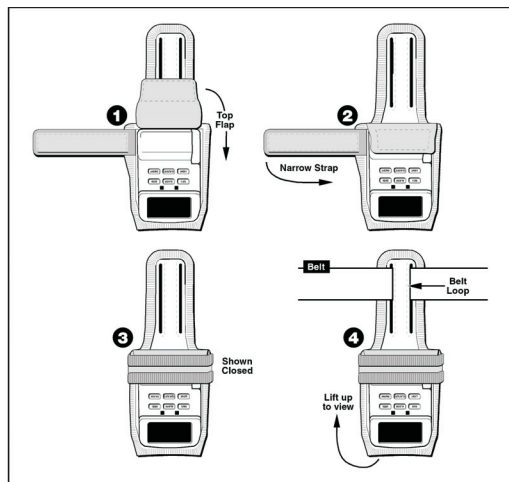


Figure 2 Using the Carrying Case

## 4. Operational Verification Tests

---

These Operational Verification Tests should be performed periodically, as required by your departmental procedures.

### Installing the Batteries

The first time you take your UltraRadiac™ out of its shipping carton, you'll have to install its batteries. See "The Batteries" on page 41 for instructions.

### Turning the Unit On

Press and hold the ON/OFF key until the display appears, then release the key.

- The unit will display the numbers 0, 1, 2, 3, 4, in sequence.
- The Rate Mode display should appear, with the word RATE shown at the top left of the screen (Figure 3).
- If a **b** or a blinking BAT indicator appear in the display or if the display is blank, refer to "The Battery Life Indicators" (page 11).

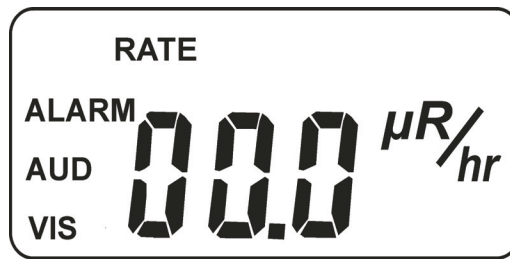


Figure 3 The Rate Display

- AUD and VIS indicate that the Audio and Visual alarms are both enabled.
- The unit will start counting and displaying the instantaneous Rate. Naturally occurring background radiation will cause the unit to display a low reading.<sup>1</sup>
- To switch to the Dose Mode, press the DOSE key.
- Press the RATE key to return to the Rate Mode.
- The rate units indicator ( $\mu\text{R}/\text{hr}$ ) will blink slowly to show that the Rate Mode is active.

1. Naturally occurring background radiation typically measures less than 20  $\mu\text{R}/\text{h}$  or 0.20  $\mu\text{Sv}/\text{h}$ .

Note: Because the UltraRadiac automatically adjusts its display to accommodate the amount of data, the units (**R**, for instance) may be displayed with a prefix. For instance, at natural background levels, you'll see  $\mu\text{R}$ , microroentgens.

At higher exposure rates, the display will change to **mR** (milliroentgens). With large exposure rates, it will show just **R**. It's important to understand these units because each one is 1000 times greater than the previous one.

## Turning the Unit Off

To turn the unit off:

- Press and hold the ON/OFF key.
- *OFF* will be displayed.
- Then you'll see - - - .
- Release the ON/OFF key; the unit will turn its power off.

All data collected up to this time will be stored in memory.

## Instrument Test

While in the Rate Mode, press and hold the CLR/TEST key until you see the test display in Figure 4, then release the key<sup>2</sup>.



Figure 4 The Test Display

## Display Test Sequence

- A set of numbers in the following order will appear. Check that all of the numbers are exactly as shown below.

---

2. The 'GN' located in the upper right corner of the display is used only by maintenance technicians. It's shown here so you can verify that the entire display is operating properly.

00.0 $\mu R$
111 $\mu R$
2.22 $mR$
33.3 $mR$
444 $mR$
5.55 $R$
66.6 $R$
777 $R$
888 $R$
999 $R$
00.0 $\mu R$
9 (blinking)

- The blinking 9 indicates that the unit passed all tests. A blinking 0 indicates a failure; contact your local Canberra Service Center.
- Press the CLR/TEST key to return to Rate Mode (or wait about 10 seconds).

### Checking the Alarm

At any time during the Clr/Test sequence of numbers:

- Press the RATE key – the audio alarm should sound and the Rate LED, the left



hand one below the display, should turn on.

- Press the DOSE key – the audio alarm should sound and the Dose LED, the right hand one below the display, should turn on.
- Press the ALARM key – the audio alarm should sound and both LEDs should turn on.
- If the optional vibrator alarm is installed, the unit will vibrate when any of these three keys is pressed.

### Checking the Function Keys

When the **000** display appears during the “Testing the Display” sequence, press each function key in turn, except the ON/OFF key.

The unit will beep and display the indications shown in the following table. Any other numerical indication indicates a fault in that key’s circuit.

Function	Indication
DOSE	002
ALARM	010
RATE	001
LIGHT	020
CLR/TEST	004

### Ending the Display Test

At the end of the test sequence, the blinking *9* will appear, indicating that the Rate Mode is operational. A blinking *0* indicates a failure; contact your local Canberra Service Center.

The unit will return to the Rate Mode in about ten seconds.

### Backlight Test

Press the LIGHT key; the display's backlight will turn on for about five seconds. This function is meant to be used in total darkness; the backlight may not be visible in daylight or normal room lighting.

### Sleep Mode Test

Press and hold the RATE key, then press the ON/OFF key.

- The characters *SLP* will be displayed briefly.
- When you see - - -, release both keys.
- You'll see the SLEEP indicator at the top of the screen (Figure 5).

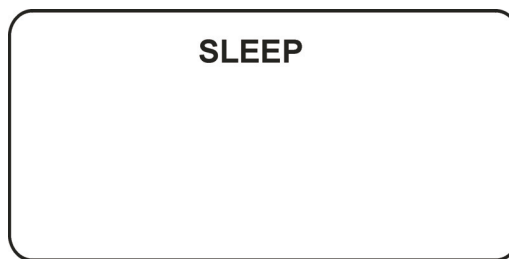


Figure 5 The Unit is Asleep

- To wake the unit, press and hold the ON/OFF key until the SLEEP indicator disappears.
- The unit will cycle through the *0-4* startup sequence, then return to the Rate Mode.

### Completing the Tests

When the UltraRadic has passed all tests, the unit is ready for operation.

If the unit fails any of these Operational Verification Tests, contact your local Canberra Service Center.

### GM Tube Failure Indication

If the unit's Geiger-Mueller tube should stop counting, the display will flash, showing three rows of three dashed lines each (Figure 6).

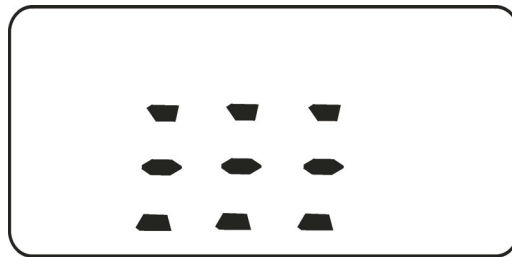


Figure 6 The GM Tube Has Failed

Contact your local Canberra Service Center for repairs.

## Operation at Low Temperatures

At temperatures below  $-22^{\circ}\text{F}$  ( $-30^{\circ}\text{C}$ ), it takes somewhat longer for characters to form on the display. The UltraRadic automatically corrects for this by sensing the ambient temperature and increasing the display refresh time from two to five seconds. Operation of the UltraRadic is otherwise unchanged.

## Error Displays

Above 500 R/hr (5.0 Sv/h), the upper three-segment bar (— —) on the display will begin flashing to indicate that:

- The dose rate exceeds the range of the UltraRadic.
- The error might be greater than 20%.
- The value of the displayed dose rate (and consequently of the calculated dose) is not accurate.
- The “true rate” might be significantly higher than the displayed value.

## 5. Setting Up the Unit

---

This chapter has been written for the System Administrator, the person responsible for your organization's UltraRadiacs™. It describes each of the unit's functions and gives detailed instructions on how to set and enable the alarms. This is applicable only if the functions were not disabled by the optional Model S900 UltraRadic Setup Software.

### CAUTION



To make your changes permanent, you must go through the entire setup sequence outlined in this chapter.

Exiting the sequence before it is complete, such as by changing only one parameter then waiting 10 seconds for the display to return to the Rate Mode, will cause all changes to be lost when the unit is turned off.

## The Rate Mode

To turn the UltraRadiac on, press and hold ON/OFF key until you see the Rate display in Figure 7.



Figure 7 The Rate Display

## The Rate Alarms

There are two Rate Alarm Thresholds: Low Rate, for a minor hazard, and High Rate, for a severe hazard.

The alarm indicators will remain enabled as long as you remain in the radiation area that triggered the alarm.

### High Threshold

There are several indicators for the High Rate Alarm Threshold (Figure 7).

- **Visual Enabled** – The entire display and the left LED will flash quickly.
- **Audio Enabled** – The audio will beep quickly.
- **Optional Vibrator Enabled** – The unit will vibrate.

#### Low Threshold

There are several indicators for the Low Rate Alarm Threshold (Figure 7).

- **Visual Enabled** – The RATE and ALARM indicators and the left LED will flash slowly.
- **Audio Enabled** – The audio will beep slowly.
- **Optional Vibrator Enabled** – The unit will vibrate.

The optional Vibrator Alarm can be used in addition to the audio and visual alarms when background noise makes the audio alarm hard to hear.

#### Reading the Rate Alarm Thresholds

- Press the ALARM and RATE keys.
- You'll see an H, for High Level Alarm, displayed.



- To read the Low Level Alarm setting, press the RATE key again; the display will show an L.
- Press the CLR/TEST key; the flashing display will show the selected (H or L) alarm threshold setting.
- If the optional Vibrator Alarm has been activated, the display will alternate between the threshold value and a vertically scrolling horizontal bar (— —).

### **Changing the Rate Alarm Indicators**

- Press the ALARM and RATE keys.
- You'll see an H, for High Level Alarm, displayed.
- To change the Low Level indicators, press the RATE key again; the display will show an L.
- Press the CLR/TEST key to access the selected (H or L) indicators.
- Repeatedly press the ALARM key until you see the desired combination of indicators, AUDio, VISual, vibrator (— —), or no indicators.

### **Changing the Rate Alarm Thresholds**

To change the High level (H) or Low level (L) settings:

- Press the ALARM and RATE keys.
- You'll see an H, for High Level Alarm, displayed.
- To access the Low Level Alarm settings, press the RATE key again; the display will show an L.
- Press the CLR/TEST key; the flashing display will show the selected alarm level (H or L) settings.
- If the optional Vibrator Alarm has been activated, the display will alternate between the threshold value and a vertically scrolling horizontal bar (— —).

### **Changing the Alarm Indicators**

To choose one or more of the alarm indicators for the selected alarm level:

- Repeatedly press the ALARM key until you see the desired combination of indicators, AUDio, VISual, vibrator, or no indicators.

### **Setting the Alarm Threshold**

To set the threshold for the selected alarm level (Figure 8):

- Press the CLR/TEST key; the decimal point and the threshold unit indicator will begin to flash.

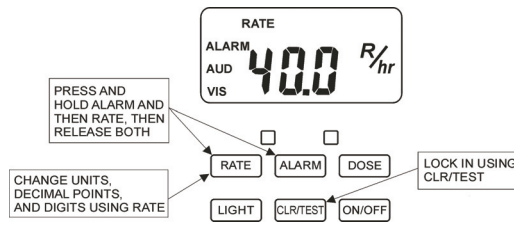


Figure 8 Changing the Rate Alarm Threshold

- Repeatedly press the RATE key until the desired decimal point location and threshold unit indication are displayed.
- Press the CLR/TEST key. This action will lock in the selected decimal point location and threshold unit indication.
- The left-most digit will begin to flash.
- Repeatedly press the RATE key until the desired value of the digit is displayed.
- Press the CLR/TEST key to lock in the digit's value. The next digit will begin to flash.
- Repeat the above two steps to select and lock in each of the two remaining digits.

- When the last digit has been set, the entire threshold value and unit will flash.
- Press the CLR/TEST key to return to the Rate Mode or wait about 10 seconds.

### The Dose Mode

When the unit is on, dose data is continuously accumulated and updated every two seconds.

- To enter the Dose Mode, press the DOSE key.
- The Dose Mode display (Figure 9) will show you the dose that has accumulated since the unit's memory was last reset to zero.

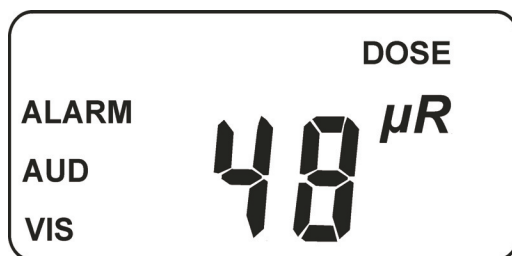


Figure 9 A Typical Dose Display

The AUD and VIS display indicators will be seen only if the corresponding Dose Alarm mode and its indicator have been enabled. See “Selecting the Dose Alarm Indicator” on page 33.

### The Dose Alarms

There are two Dose Alarm thresholds: Low Dose, for a minor hazard, and High Dose, for a severe hazard.

The alarm indications will continue as long as you remain in the radiation area that triggered the alarm.

The optional Vibrator Alarm can be used in addition to the audio and visual alarms when background noise makes the audio alarm hard to hear.

### High Threshold

There are several indicators for the High Dose Alarm Threshold (Figure 9).

- **Visual Enabled** – The DOSE and ALARM indicators and the right LED will flash quickly.
- **Audio Enabled** – The audio will beep quickly.
- **Optional Vibrator Enabled** – The unit will vibrate.

### Low Threshold

There are several indicators for the Low Rate Alarm Threshold (Figure 9).

- **Visual Enabled** – The ALARM indicator and the right LED will flash slowly.
- **Audio Enabled** – The audio will beep slowly.
- **Optional Vibrator Enabled** – The unit will vibrate.

### Reading the Dose Alarm Thresholds

- Press the ALARM and DOSE keys.
- You'll see an H, for High Level Alarm, displayed.
- To read the Low Level Alarm setting, press the DOSE key again; the display will show an L.
- Press the CLR/TEST key; the flashing display will show the selected (H or L) alarm threshold setting.
- If the optional Vibrator Alarm has been activated, the display will alternate between the threshold value and a vertically scrolling horizontal bar (---), showing that the vibrator alarm is active.

- The unit will automatically return to the Rate Mode display about 10 seconds after the last keypress.

### **Changing the Dose Alarm Indicators**

- Press the ALARM and DOSE keys.
- You'll see an H, for High Level Alarm, displayed.
- To change the Low Level indicators, press the DOSE key again; the display will show an L.
- Press the CLR/TEST key to access the selected (H or L) indicators.
- Repeatedly press the ALARM key until you see the desired combination of indicators, AUDio, VISual, vibrator (---), or no indicators.
- The unit will automatically return to the Dose Mode display about 10 seconds after the last keypress.

### **Changing the Dose Alarm Thresholds**

To change the High level (H) or Low level (L) settings:

- Press the ALARM and DOSE keys.
- You'll see an H, for High Level Alarm, displayed.

- To access the Low Level Alarm settings, press the DOSE key again; the display will show an L.
- Press the CLR/TEST key; the flashing display will show the selected alarm level (Hor L) settings.
- If the optional Vibrator Alarm has been activated, the display will alternate between the threshold value and a vertically scrolling horizontal bar (— —).

#### **Setting the Alarm Threshold**

To set the threshold for the selected alarm level:

- Press the CLR/TEST key; the decimal point and the threshold unit indicator will begin to flash.
- Repeatedly press the DOSE key until the desired decimal point location and threshold unit indication are displayed.
- Press the CLR/TEST key. This action will lock in the selected decimal point location and threshold unit indication.
- The left-most digit will begin to flash.
- Repeatedly press the DOSE key until the desired value of the digit is displayed.



- Press the CLR/TEST key to lock in the digit's value. The next digit will begin to flash.
- Repeat the above two steps to select and lock in each of the two remaining digits.
- When the last digit has been set, the entire threshold value and unit will flash.
- Press the CLR/TEST key to return to the Rate Mode or wait about 10 seconds.

### **The Source Finder Mode**

The Source Finder Mode allows the unit to locate an isolated source. In this mode, the unit will start clicking if the unit is near radioactive material. As you move closer to the radioactivity (or farther away), the unit will click faster (or slower).

For best results, aim the top of the unit at the suspected source of the radiation.

The Rate and Dose modes are active when the Source Finder Mode is enabled. This means that you can read the higher Rate or Dose without exiting the Source Finder Mode.

### Enabling the Source Finder Mode

- Press and hold the RATE key until the display changes to a flashing *1*.
- Release the RATE key.

### Exiting the Source Finder Mode

- Press and hold the RATE key until the display changes to a flashing *0*.
- Release the RATE key.

### The Sleep Mode

When the Sleep Mode is enabled, most of the unit's circuits will be turned off to conserve battery power. Every 5 minutes, the unit will wake up for 4–6 seconds and check the current Rate.

**WARNING** DO NOT place the unit in Sleep Mode before responding!



Doing so can expose you to radiation for as long as five minutes before you are alerted.

### Enabling the Sleep Mode

- Press and hold the RATE key, then press the ON/OFF key until you see *SLP* on the display.

- When you see - - -, release both keys.

You'll see the SLEEP indicator at the top of the screen (Figure 10).

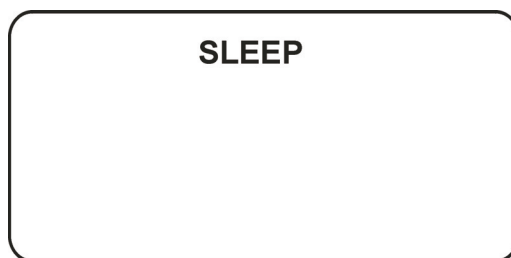


Figure 10 The Unit is Asleep

#### **When the Unit Wakes Up**

- It compares the current Rate with the Rate Alarm thresholds.
- If a Rate Alarm is triggered, the unit will stay awake.
- If no Rate Alarm thresholds have been exceeded, the unit will go back to sleep for five minutes.
- This wake-sleep cycle will repeat continuously until the Sleep Mode is cancelled.

Note: The unit does not accumulate Rate or Dose data while asleep.

### Exiting the Sleep Mode

To exit the Sleep Mode:

- Press and hold the ON/OFF key until the unit starts cycling through the 0-4 startup sequence.
- The unit will then enter the Rate Mode.

### The Data Logging Mode

The Data Log lets you record up to 300 individual dose/rate data pairs, each with an index number, for later retrieval. This is useful for performing a survey or for cataloging readings.

### Capturing Data Pairs

To capture data pairs, the unit must be ON and in the Rate Mode.

- Press the RATE and DOSE keys together.
- Hold both buttons down until the displayed number stops blinking (in about three seconds),
- The next sequential rate/dose pair index number will appear.

- Release both buttons. The unit will save the data pair and its index, then return to the Rate Mode. This process takes about 10 seconds.
- To record another reading, point the unit at the location to be recorded and repeat the process.

### **Viewing the Data Log**

To view the stored data, the unit must be OFF.

- Press the RATE and OFF/ON keys together.
- When the unit turns on, the last sequence number recorded will be displayed.
- Press the RATE button to scroll down, or the DOSE button to scroll up, through the memory.
- The first number shown in the display will be the index number, scrolling up (DOSE button) will next display the Rate data and scrolling up once again will display the Dose data.
- Scrolling down (RATE button) will reverse the order of sequence numbers but will still display first Rate data then Dose data.

- Scrolling will wrap around the memory, from first index entry to last, or last to first.

To return to normal operation, the unit must be turned off and then on again (normal turn on sequence).

When the 300<sup>th</sup> sequence number has been recorded, the unit will cycle back to the first sequence number and any new data records will overwrite the previously recorded data in that location.

### **Clearing the Data Log**

To clear all stored data, you must be in the Viewing the Data Log mode. (See the previous section.)

- While pressing both the RATE and ALARM keys, press and hold the CLR/TEST key for two seconds.
- The first index number (1) will appear
- This indicates that all data has been cleared.
- To return to the Rate/Dose mode of operation, turn the unit OFF, then back ON.

## 6. Maintenance Procedures

---

Preventive maintenance consists of routine checks of the equipment before and after each mission, or as required by procedure.

### Routine Checks Include:

- Cleaning the unit.
- Inspecting the battery compartment's door gasket.
- Inspecting the battery contacts for corrosion.

### Cleaning the Unit

Remove dust, moisture and loose dirt from the outside surfaces of the UltraRadiac™ with a clean soft cloth. If necessary, the unit may be cleaned with a mild solution of ordinary detergent and water, rinsed, and thoroughly dried.

### The Batteries

If you're installing batteries for the first time, the following caution can be disregarded. If you're replacing the batteries, **be sure to turn the unit off first.**

### Installing or Replacing the Batteries

- To open the battery compartment door, turn its fastener a quarter-turn counter-clockwise, swing the door open and slide out all four batteries.
- Install fresh batteries in the order shown in Figure 11.

#### CAUTION



**Be sure to observe the polarity** next to each of the four battery slots. The end of the battery facing out should match the slot's marked polarity, as shown in Figures 11 and 12.



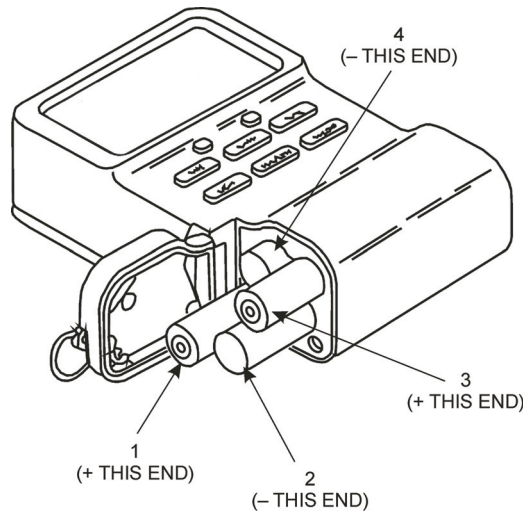


Figure 11 Location of the Batteries

- With the batteries correctly installed, close and latch the door. See “Latching the Compartment Door” on page 46.

## BATTERIES (END VIEW)

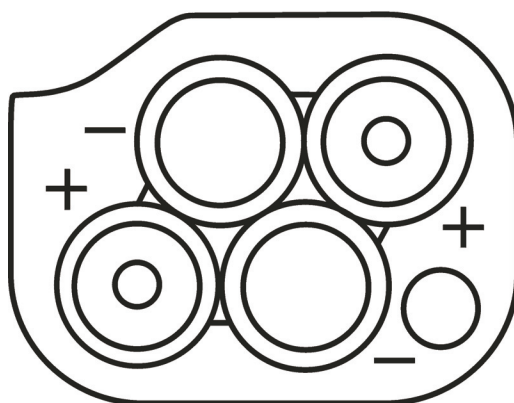


Figure 12 The Battery Polarity Indicators

### The Battery Compartment

To open the battery compartment door, turn its latch a quarter-turn counterclockwise and swing the door open.

- Inspect the four battery contacts on the inside of the door (Figure 13). If any corrosion is seen, clean it off with a pencil eraser.

- Inspect the seal on the inside of the door (Figure 13); it should be whole and entire. If the seal is cracked or broken, the unit may no longer be watertight.
- Inspect the O-ring seal around the door latch's post (Figure 13). If the seal is cracked or broken, the unit may no longer be watertight.

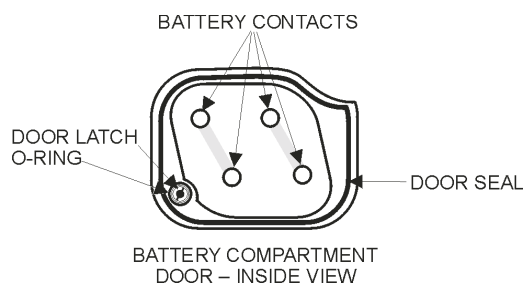


Figure 13 The Inside of the Battery Door

- For repair, contact your local Canberra Service Center.
- When the inspection is complete, close and latch the door. See the following section “Latching the Compartment Door”.

### **Latching the Compartment Door**

Swing the battery cover closed, press it firmly against the unit and turn the fastener a quarter-turn clockwise.

Note: It may be necessary to turn the fastener slightly to line it up with the latch post before latch will engage.

When the door is properly closed, it will be possible to lay the fastener's D-ring down in the cover's fastener recess.

Note: When the door is latched, the unit may turn itself on in the Sleep Mode.  
To return to normal operation:

- Press and hold the ON/OFF key for about 2 seconds.
- The unit will cycle through the display startup sequence (page 14), then enter the Rate Mode.

## A. Specifications

---

### Features

DOSE RATE – MRAD<sub>xy1</sub>: 1  $\mu$ Sv/h to 5 Sv/h;  
MRAD<sub>xy3</sub>: 1.0  $\mu$ R/h to 500 R/h.

DOSE – MRAD<sub>xy1</sub>: 0.001  $\mu$ Sv to 999 Sv;  
MRAD<sub>xy3</sub>: 0.1  $\mu$ R to 999 R.

PRESETTABLE AUDIBLE AND VISUAL  
ALARMS – User-defined and -set dose and  
dose rate alarms.

INITIALIZATION TIME – Operational in  
less than 5 seconds.

SETUP TIME – Less than one minute for all  
checks and alarms.

ACCURACY – Linear up to 3.5 Sv/h  
(350 R/h)  $<\pm 15\%$ , and within  $\pm 20\%$  of the  
actual dose rate from 3.5 Sv/h (350 R/h) to  
5.0 Sv/h (500 R/h).

DATA RECORDING – Local data logging to  
300 data points; data downloadable via optical  
(IR) communications port.

SELF MONITORING – Continual self-moni-  
toring for the instrument's state of health.

CASE – Die-cast aluminum; available in black or yellow.

EMI SUSCEPTIBILITY – Will not be affected, or cause other equipment to be affected, by its use.

OPERABLE AND READABLE – By persons wearing protective clothing.

## **Detector**

DETECTOR – Energy compensated GM tube.

GAMMA ENERGY DEPENDENCE –  $\pm 30\%$ , 60 keV to 1.3 MeV.

TOTAL (ACCUMULATED) DOSE  
READOUT – Will not be erased when read; resettable to zero as desired.

RESPONSE TIME – Achieves 90% of final reading in four seconds; returns to background within four seconds; updates in two seconds.

## **Display**

LCD – Readable at 3 ft (1 m), updated every two seconds; can be backlit for night use.

UNITS – MRAD<sub>xy1</sub> provides data in units of  $\mu\text{Sv}$ ,  $\text{mSv}$ ,  $\text{Sv}$ ,  $\mu\text{Sv/h}$ ,  $\text{mSv/h}$  and  $\text{Sv/h}$ ; MRAD<sub>xy3</sub> provides data in units of  $\mu\text{R}$ ,  $\text{mR}$ ,  $\text{R}$ ,  $\mu\text{R/h}$ ,  $\text{mR/h}$  and  $\text{R/h}$ .

## Alarms

SELECTABLE ALARMS – Has selectable Visual and Audible indicators for day or night use; alarm levels are settable over entire dynamic range.

ALARM TYPES – Alarm on dose rate and total cumulative dose.

ALARM LEVELS – Two alarm levels available for each type to indicate minor or severe hazard.

AUDIBLE ALARM – 85 dBA at 11.8 in. (30 cm).

VIBRATION ALARM – Optional.

## Power

BATTERIES – Four AAA 1.5 V alkaline batteries.

MINIMUM BATTERY LIFE – 150 hours during continuous monitoring at normal background, room temperature and without alarms.

LOW BATTERY INDICATION – Triggered when the remaining battery life is approximately 10 hours; allows display of remaining time in minutes.

## **Environmental**

OPERATING TEMPERATURE: –22 °F to 141 °F (–30 °C to +61 °C).

STORAGE/TRANSPORT TEMPERATURE: –40 °F to 158 °F (–40 °C to +70 °C).

HUMIDITY – 0–100%.

WATER IMMERSION – 3 ft (1 m) for at least 2 hr.

SAND/DUST – Operates in winds with exposure to fine dust and sand particles.

VIBRATION AND SHOCK – Withstands vibration associated with transport and shocks of dropping while in use.

## **Physical**

DIMENSIONS – 3.9 x 2.7 x 1.1 in. (100 x 69 x 29 mm) (HWD).

WEIGHT – 9.5 oz. (269 g), including batteries.



VOLUME – 12.2 in.<sup>3</sup> (199 cm<sup>3</sup>).

### **Qualification Testing**

The UltraRadiac™ is a commercial version of Canberra's Models AN/UDR-13 and AN/UDR-14 Radiac Set which were designed and qualified to meet the requirements of MIL-STD-810E. Details available upon request.

### **Ordering Information**

Model MRAD<sub>xyz</sub> UltraRadiac Personal Radiation Monitor.

Where:

x: 1 = yellow case; 2 = black case.

y: 0 = no vibration alarm; 1 = vibration alarm.

z: 1 = sievert units; 3 = roentgen units.

## B. Default Alarm Settings

The Dose and Rate alarm settings (thresholds) for the UltraRadiac™ are factory set to the values in the following tables.

<b>R</b>	<b>Low Setting</b>	<b>High Setting</b>
Rate	500 $\mu$ R/hr	2 R/hr
Dose	100 mR	10 R

<b>Sv</b>	<b>Low Setting</b>	<b>High Setting</b>
Rate	1 Sv/hr	100 Sv/hr
Dose	1 mSv	100 mSv

The factory settings can be changed manually (refer to Chapter 5, *Setting Up the Unit*), or via the optional Model S900 UltraRadiac Setup Software.

**CAUTION**

The System Administrator is responsible for determining and setting the proper operational alarm thresholds for each UltraRadic.

## C. Display Units

Your unit's display will show R or Sv<sup>1</sup>. Any unit can have larger and smaller subunits, which are indicated by prefixes. As the Rate and Dose change, the UltraRadiac™ will automatically adjust its displayed units.

For example: The Rate may start with  $\mu\text{R}/\text{h}$  (natural background radiation is less than 20  $\mu\text{R}/\text{h}$ ). If the Rate increases beyond 999  $\mu\text{R}/\text{h}$ , the display will change to  $\text{mR}/\text{h}$ .

micro ( $\mu$ )	$\mu\text{R}$ – one millionth of a roentgen
milli (m)	$\text{mR}$ – one thousandth of a roentgen (or $\mu\text{R}$ times 1000)
centi (c)*	$\text{cR}$ – one hundredth of a roentgen (or $\text{mR}$ times 10)
the base unit	$\text{R}$ – one roentgen ( $\text{cR}$ times 100)

\*The 'centi' prefix will be seen only on UltraRadiacs displaying sievert units.

---

1. The display units are set at the factory; they are not user changeable.

## D. Glossary

---

These brief explanations are included to define terms used in this manual.

### **Dose**

The total amount of radiation received. Also called Accumulated Dose.

### **Dose Rate**

The average rate (in time) of radiation; e.g., Roentgen per hour. Also called Rate.

### **Rate**

The amount of radiation measured by the UltraRadiac™ every 2 seconds, then extrapolated to and displayed as units per hour.

### **Roentgen (R)**

Unit of measure of radiation exposure; monitors the amount of radiation received.

### **Sievert (Sv)**

Unit of measure of absorbed radiation; monitors the biological danger of radiation.

### **Stay Time**

The Stay Time is how much time remains, at the current Dose Rate, before the High Dose Alarm is triggered.

Stay Time is calculated by dividing (the High Dose Alarm Setpoint minus the already accumulated Dose) by the current Dose Rate, then converting the result to minutes.

If the display reads 999, the maximum, your Stay Time is at least 16.5 hours.

**WARNING**



If the Dose Rate goes up, your remaining Stay Time will go down.

You should check your Stay Time frequently when you are in the presence of radiation.

## E. Disposing of This Equipment

---

Electrical and electronic equipment contain hazardous substances that, if disposed of improperly, can have a negative effect on the environment and on human health.

Users / owners of this equipment have the responsibility to ensure that this equipment does not pose a threat to the environment or to humans when it becomes obsolete and requires disposal.

The symbol below, also found on your CANBERRA equipment, indicates that this equipment should not be disposed of in unsorted municipal waste.



Therefore, following the provisions of COUNCIL DIRECTIVE 2002/96/EC on waste electrical and electronic equipment (WEEE), we ask that you contact your nearest CANBERRA office for instructions on the proper disposal of this equipment.



## Notes





### Warranty

Canberra (we, us, our) warrants to the customer (you, your) that for a period of ninety (90) days from the date of shipment, software provided by us in connection with equipment manufactured by us shall operate in accordance with applicable specifications when used with equipment manufactured by us and that the media on which the software is provided shall be free from defects. We also warrant that (A) equipment manufactured by us shall be free from defects in materials and workmanship for a period of one (1) year from the date of shipment of such equipment, and (B) services performed by us in connection with such equipment, such as site supervision and installation services relating to the equipment, shall be free from defects for a period of one (1) year from the date of performance of such services.

If defects in materials or workmanship are discovered within the applicable warranty period as set forth above, we shall, at our option and cost, (A) in the case of defective software or equipment, either repair or replace the software or equipment, or (B) in the case of defective services, reperform such services.

### LIMITATIONS

EXCEPT AS SET FORTH HEREIN, NO OTHER WARRANTIES OR REMEDIES, WHETHER STATUTORY, WRITTEN, ORAL, EXPRESSED, IMPLIED (INCLUDING WITHOUT LIMITATION, THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE) OR OTHERWISE, SHALL APPLY. IN NO EVENT SHALL CANBERRA HAVE ANY LIABILITY FOR ANY SPECIAL, EXEMPLARY, PUNITIVE, INDIRECT OR CONSEQUENTIAL LOSSES OR DAMAGES OF ANY NATURE WHATSOEVER, WHETHER AS A RESULT OF BREACH OF CONTRACT, TORT LIABILITY (INCLUDING NEGLIGENCE), STRICT LIABILITY OR OTHERWISE. REPAIR OR REPLACEMENT OF THE SOFTWARE OR EQUIPMENT DURING THE APPLICABLE WARRANTY PERIOD AT CANBERRA'S COST, OR, IN THE CASE OF DEFECTIVE SERVICES, REPERFORMANCE AT CANBERRA'S COST, IS YOUR SOLE AND EXCLUSIVE REMEDY UNDER THIS WARRANTY.

## **EXCLUSIONS**

Our warranty does not cover damage to equipment which has been altered or modified without our written permission or damage which has been caused by abuse, misuse, accident, neglect or unusual physical or electrical stress, as determined by our Service Personnel.

We are under no obligation to provide warranty service if adjustment or repair is required because of damage caused by other than ordinary use or if the equipment is serviced or repaired, or if an attempt is made to service or repair the equipment, by other than our Service Personnel without our prior approval.

Our warranty does not cover detector damage due to neutrons or heavy charged particles. Failure of beryllium, carbon composite, or polymer windows, or of windowless detectors caused by physical or chemical damage from the environment is not covered by warranty.

We are not responsible for damage sustained in transit. You should examine shipments upon receipt for evidence of damage caused in transit. If damage is found, notify us and the carrier immediately. Keep all packages, materials and documents, including the freight bill, invoice and packing list.

## **Software License**

When purchasing our software, you have purchased a license to use the software, not the software itself. Because title to the software remains with us, you may not sell, distribute or otherwise transfer the software. This license allows you to use the software on only one computer at a time. You must get our written permission for any exception to this limited license.

## **BACKUP COPIES**

Our software is protected by United States Copyright Law and by International Copyright Treaties. You have our express permission to make one archival copy of the software for backup protection. You may not copy our software or any part of it for any other purpose.

Revised 1 Apr 03